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Abstract. A Majorana neutrino is characterized by just one flavor diagonal electromagnetic form factor: the anapole moment, that in the static limit corresponds to the axial vector charge radius $\langle r_A^2 \rangle$. As is the case for the vector charge radius of a Dirac neutrino, proving that this quantity is a well defined physical quantity is non trivial. I will first describe briefly the origin of the long standing controversy about the physical or non physical nature of the neutrino charge radius. Then I will argue that, in contrast to Dirac neutrino electromagnetic form factors, for Majorana neutrinos cosmological and astrophysical arguments do not provide useful informations on $\langle r_A^2 \rangle$. Therefore this quantity has to be studied by means of terrestrial experiment. Finally, I will discuss the constraints that can be derived on $\langle r_A^2 \rangle$ for the tau neutrino from a comprehensive analysis of the data on single photon production off Z-resonance, and I will conclude with a few comments on ν_μ scattering data from the NuTeV, E734, CCFR and CHARM-II collaborations and on the limits implied for $\langle r_A^2 \rangle$ for the muon neutrino.

On the neutrino vector and axial vector charge radius[1]

Enrico Nardi

I INTRODUCTION

Experimental evidences for neutrino oscillations [1,2] imply that neutrinos are the first elementary particles whose properties cannot be fully described within the Standard Model (SM). This hints to the possibility that other neutrino properties might substantially deviate from the SM predictions, and is presently motivating vigorous efforts, both on the theoretical and experimental sides, to understand more in depth the physics of neutrinos and of their interactions.

Neutrinos electromagnetic interactions can play an important role in a wide variety of domains, as for example in cosmology [3] and in astrophysics [4,5]. The electromagnetic properties of Dirac neutrinos are described in terms of